

CHAPTER FOUR

INTERPRETING THE FLOODPLAIN ORDINANCE

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A. Introduction

The State Model Floodplain Management Ordinance and the NFIP regulations therein must be interpreted correctly for effective implementation. Numerous clarifying letters have been compiled by FEMA into a Policy Book to provide guidance in explaining the NFIP regulations. The Policy Book is located at the State Coordinating Office and the FEMA Regional office and is often used to answer questions from NFIP communities. The guidance is derived from questions that have been raised by communities about how the NFIP regulations should be interpreted. In addition, FEMA has recently published a series of seven Technical Bulletins to assist in interpreting the regulations. These include a User's Guide, Openings in Foundation Walls, Flood Resistant Materials Requirements, Non-Residential Floodproofing, Elevator Installation, Free-of-Obstruction Requirements, Below-Grade Parking Requirements, and Wet Floodproofing Requirements. This chapter summarizes answers to frequently asked questions about the ordinance and the NFIP regulations.

B. Development - Requirements for a Permit

The Floodplain Ordinance requires that a permit be issued for all floodplain development. Development is broadly defined as "any man-made change to improved or unimproved real estate, including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavating, or drilling operations or storage of equipment or materials." This includes subdivision of land. Some activities require little more than making a floodplain determination and issuing a permit. For example, a picnic pavilion in the floodplain is not considered a structure and would not need to be elevated, but needs a permit stating that it should be constructed of flood resistant materials and anchored to prevent flotation during flooding. Underground liquid storage tanks are considered structures and need a permit requiring certification that they are adequately anchored to prevent flotation during the 100-year flood and that the contents will not escape into floodwaters. Grading and fill activities in the 100-year floodplain require a permit. A permit is required for temporary storage of materials in the floodplain and should not be issued if the materials are of a hazardous nature. Mining, dredging, drilling, dumping, and clearing activities require floodplain permits.

Local governments must issue permits for their own activities in the 100-year floodplain. The only exceptions to the requirement for a floodplain permit are federal projects which take place on federal land and State projects on State land. A project built on private land for lease to a State agency requires a local permit. Likewise, a federally funded project built on private land requires a permit.

The local permitting official is the main point of contact for an applicant and should provide advice concerning other State or federal permits that may be required. It is a good practice not to issue local permits until evidence is provided that all other necessary permits have been issued. In some cases, a "Letter of Authorization" or of "no jurisdiction" from MDE or the Army Corps of Engineers is sufficient to assure that a permit was sought from a State or federal agency. The applicant must be directed that no development may begin until all necessary permits have been obtained. In cases where a local permit cannot be issued, the local official should notify MDE to stop processing the State permit unless local issues can be resolved.

Local officials have an important role in preventing avoidable floodplain development. The Model Ordinance has an Avoidance and Minimization clause which charges the permit official with assisting the applicant to avoid development in the floodplain, if possible, or, if unavoidable, to minimize the impact before a permit is issued. Strict adherence to this provision will help prevent future damage and can eliminate implementing the floodplain ordinance.

C. Elevation Certificates

An Elevation Certificate is requisite proof that a building is properly elevated. The Elevation Certificate must be in the permit file before the building can pass final inspection and be issued an occupancy certificate. Only a professional land surveyor or engineer can sign and seal an Elevation Certificate. A local official can copy information onto an Elevation Certificate based on a document signed and sealed by a surveyor or engineer, and should note that this is the case. The final Elevation Certificate that is included in the permit file must be an as-built certification and may not be completed before the supporting members of the floor system are in place (eg. joists or slab). Elevation Certificates must be completed and on file for all new and substantially improved structures in the 100-year floodplain which must be elevated.

On the Elevation Certificate, the top of the floor is certified as the lowest floor in A-zones and must be at or above the FPE. The bottom of the lowest horizontal member supporting the floor system is certified in V-zones and must be at or above the FPE. The Elevation Certificate must be checked to ensure that the structure is compliant. Ideally, the elevation of the lowest floor should be verified as soon as possible after it is in place, since deficiencies can be corrected more easily early in the construction.

The Elevation Certificate is the basis for determining flood insurance rates. From an insurance rating standpoint, a determination of a structure's lowest floor provides a mechanism for defining the exposure to risk, and thus allows

O.M.B. NO. 3067-0077
Expires May 31, 1996

ELEVATION CERTIFICATE

**FEDERAL EMERGENCY MANAGEMENT AGENCY
NATIONAL FLOOD INSURANCE PROGRAM**

ATTENTION: Use of this certificate does not provide a waiver of the flood insurance purchase requirement. This form is used only to provide elevation information necessary to ensure compliance with applicable community floodplain management ordinances, to determine the proper insurance premium rate, and/or to support a request for a Letter of Map Amendment or Revision (LOMA or LOMR). Instructions for completing this form can be found on the following pages.

SECTION A PROPERTY INFORMATION		FOR INSURANCE COMPANY USE
BUILDING OWNER'S NAME		POLICY NUMBER
STREET ADDRESS (including Apt., Unit, Suite and/or Bldg. Number) OR P.O. ROUTE AND BOX NUMBER		COMPANY NAIC NUMBER
OTHER DESCRIPTION (Lot and Block Numbers, etc.)		
CITY	STATE	ZIP CODE

SECTION B FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

Provide the following from the proper FIRM (See Instructions):

1. COMMUNITY NUMBER	2. PANEL NUMBER	3. SUFFIX	4. DATE OF FIRM INDEX	5. FIRM ZONE	6. BASE FLOOD ELEVATION (in AO Zones, use depth)
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7. Indicate the elevation datum system used on the FIRM for Base Flood Elevations (BFE): ☐ NGVD '29 ☐ Other (describe on back)

8. For Zones A or V, where no BFE is provided on the FIRM, and the community has established a BFE for this building site, indicate the community's BFE: feet NGVD (or other FIRM datum—see Section B, Item 7).

SECTION C BUILDING ELEVATION INFORMATION

- Using the Elevation Certificate Instructions, indicate the diagram number from the diagrams found on Pages 5 and 6 that best describes the subject building's reference level ____.
- (a). FIRM Zones A1-A30, AE, AH, and A (with BFE). The top of the reference level floor from the selected diagram is at an elevation of feet NGVD (or other FIRM datum—see Section B, Item 7).
(b). FIRM Zones V1-V30, VE, and V (with BFE). The bottom of the lowest horizontal structural member of the reference level from the selected diagram, is at an elevation of feet NGVD (or other FIRM datum—see Section B, Item 7).
(c). FIRM Zone A (without BFE). The floor used as the reference level from the selected diagram is feet above ☐ or below ☐ (check one) the highest grade adjacent to the building.
(d). FIRM Zone AO. The floor used as the reference level from the selected diagram is feet above ☐ or below ☐ (check one) the highest grade adjacent to the building. If no flood depth number is available, is the building's lowest floor (reference level) elevated in accordance with the community's floodplain management ordinance? ☐ Yes ☐ No ☐ Unknown
- Indicate the elevation datum system used in determining the above reference level elevations: ☐ NGVD '29 ☐ Other (describe under Comments on Page 2). (NOTE: If the elevation datum used in measuring the elevations is different than that used on the FIRM [see Section B, Item 7], then convert the elevations to the datum system used on the FIRM and show the conversion equation under Comments on Page 2.)
- Elevation reference mark used appears on FIRM: ☐ Yes ☐ No (See Instructions on Page 4)
- The reference level elevation is based on: ☐ actual construction ☐ construction drawings
(NOTE: Use of construction drawings is only valid if the building does not yet have the reference level floor in place, in which case this certificate will only be valid for the building during the course of construction. A post-construction Elevation Certificate will be required once construction is complete.)
- The elevation of the lowest grade immediately adjacent to the building is: feet NGVD (or other FIRM datum—see Section B, Item 7).

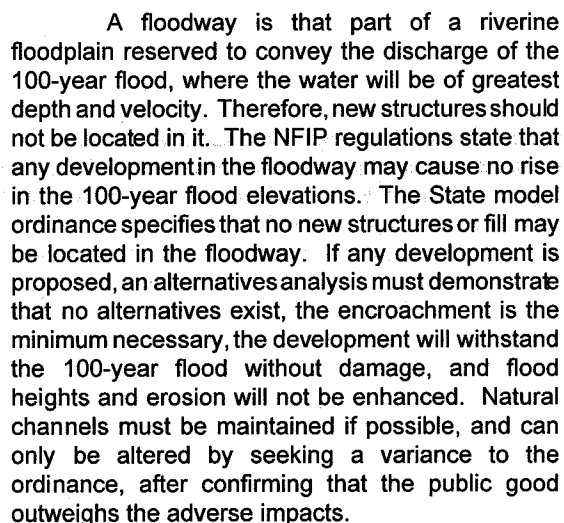
SECTION D COMMUNITY INFORMATION

- If the community official responsible for verifying building elevations specifies that the reference level indicated in Section C, Item 1 is not the "lowest floor" as defined in the community's floodplain management ordinances, the elevation of the building's "lowest floor" as defined by the ordinance is: feet NGVD (or other FIRM datum—see Section B, Item 7).
- Date of the start of construction or substantial improvement: _____

The placement of an enclosure, such as an attached garage, below the BFE does not result in the garage's floor becoming the lowest floor for insurance rating, provided that the design standards required for floodplain management purposes are met. In other words, if the garage is constructed as prescribed by the ordinance, the floor of the habitable portion of the structure is the lowest floor for rating purposes. If the attached garage is in violation of the ordinance, the Elevation Certificate must certify the floor of the garage as the lowest floor, resulting in much higher premiums for flood insurance. In extreme cases, the NFIP may deny flood insurance on structures that remain in violation of state or local laws and ordinances.

Local government has an important role in promoting good floodplain management through the review and approval of subdivision plans. The ordinance requires that a flood study be performed to delineate the 100-year floodplain and establish flood elevations when subdivisions which exceed five acres or five lots are proposed in approximate floodplain areas. All subdivision plans in areas with an FIS are required to delineate the 100-year flood elevation at the site. This allows communities to implement the requirement that new subdivisions in the nontidal floodplain subdivide land such that each lot will have a building pad which is naturally above the 100-year flood elevation. Floodplain land should be dedicated to perpetual open space uses by legal means, and natural vegetative cover preserved.

E. Floodways



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floodway structures be tracked, so that when the 50% cumulative improvement threshold is reached, the above conditions would apply. Fences, except two wire fences for livestock enclosure, are prohibited in the floodway.

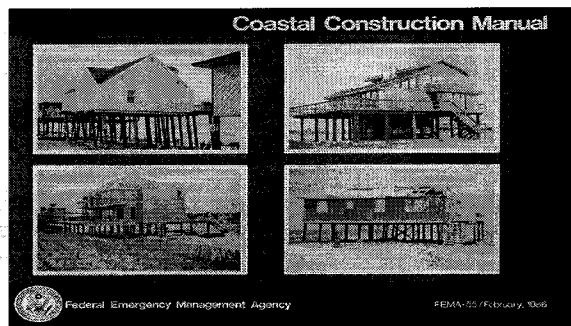
Public works, such as bridges, roads, utility crossings, may not be able to avoid floodway encroachment. The design should minimize the encroachment and interruption of service during flooding. If possible, the floodway should be spanned by elevated crossings. Water supply and sewage treatment plants should be floodproofed to prevent damage, interruption of service, and health hazards during flooding. Construction of public utilities in the floodway must not increase flood elevations.

The "no rise rule" is interpreted strictly by FEMA; there must be zero (0.00 feet) rise in flood elevations as a result of development in a designated floodway. No development which offers resistance to the flow of floodwaters may take place in the regulatory floodway unless compensatory action is taken to restore the lost conveyance. After all other conditions have been met, concurrence from FEMA must be sought in the form of a Conditional Letter of Map Revision (CLOMR) for floodway encroachments.

F. Coastal High Hazard Areas (V-Zones)

V-zones are exposed coasts where damage from a 100-year storm results from winds and waves of three feet or more, as well as from floodwaters. New and substantially improved structures must be elevated on adequately anchored pilings or columns so that the bottom of the lowest horizontal structural member supporting the lowest floor is one foot above the BFE. Generally, this would be the beam supporting the floor joists. Pilings must be driven deeply so that scour and erosion will not undermine the support for the structure. Any new development in the V-zone must undergo an alternatives analysis as outlined in Sect. 5.11 of the State model ordinance. Wind loads must be considered in the design and construction of V-zone structures. The design wind in building codes is no less than 90 miles per hour on the Maryland coast. Because of the complexity of forces involved, a professional engineer or architect knowledgeable in coastal construction must certify the proposed construction on a **V-zone Certificate**. In addition, an as-built Elevation Certificate must be completed. FEMA's Coastal Construction Manual should be consulted for further design considerations.

The area beneath an elevated V-Zone structure must be left open or enclosed by breakaway walls which are designed to collapse under specific loading forces of between 10 and 20 pounds per square foot without affecting the support system of the elevated building. Therefore, the walls can be only minimally tied into supporting members, and must be certified on the V-zone Certificate. Light wood lattice or screening may be used without certification. The enclosed space can be used only for parking of vehicles, limited storage, and access to the building. Breakaway walls need not be vented, but are permissible only in V-zones.



Accessory structures are not allowed in V-zones below the FPE. Bulkheads attached to or beneath coastal buildings are prohibited. A swimming pool may be placed beneath a coastal building only if its top is flush with grade and the area below the lowest floor of the structure is not enclosed. The pool must not be tied to the structure and must be certified to not increase damage to the building or adjacent buildings and to not break up or float out of the ground during the 100-year storm. For additional information on these requirements, see FIA Technical Bulletin 5-93, "Free-of-Obstruction Requirements".

According to the State model floodplain ordinance, existing structures in V-zones may not be substantially improved or expanded vertically or horizontally without a certification by a professional engineer or architect that the entire foundation system will support the existing building and the proposed improvement during the 100-year storm. The Model Ordinance requires that permits be tracked in V-zones, so that once cumulative improvements reach 50%, the structure must comply with the full requirements of Ordinance Section 5.12.

Development may not be placed within the reach of mean high tide, dunes must be preserved, and structural fill may not be used in V-zones. Manufactured homes are prohibited in V-zones (Sect. 5.13). Sect. 5.14 of the State Model Ordinance prohibits excavation under existing structures.

G. Fill

The use of floodplain fill is discouraged in Maryland because of the loss of flood storage capacity and drainage problems onto adjoining properties. Other methods of elevation should be considered first. Sect. 5.3 of the State Model Ordinance limits fill to 600 cubic yards, enough to elevate an average residence three to four feet. If other elevation methods are demonstrated to be unfeasible, and greater amounts of fill are needed, a variance is required. Fill used to support structures must be compacted to 95% of the maximum density obtainable by the Standard Proctor Test (ASTM Standard D-698), and its suitability to support structures certified by a registered professional engineer. Dredged material can only be used as fill upon certification of its suitability by a registered geotechnical engineer. The use of fill may not increase flooding or cause drainage problems on neighboring properties.

Fill, for floodplain management purposes, is defined as soil and rock materials only. Use of other materials is prohibited. Landfills, rubble fills, dumps, and sanitary fills are not permitted in the floodplain. Furthermore, fill shall be avoided in wetlands, no fill shall be placed in floodways, and the use of fill for structural support in V-zones is prohibited.

H. Structures

The NFIP defines a structure as a walled and roofed building, and generally requires that new and substantially improved floodplain structures be elevated. An open pavilion and a three sided implement shed are not structures and do not have to be elevated. However, a gas or liquid storage tank is a structure because it is fully enclosed. It must be elevated or anchored to prevent flotation.

The most important role of local permit officials is to work with applicants to guide the placement of structures out of the floodplain, if possible. The Model Ordinance has an Avoidance and Minimization clause that charges the local official with assuring that development avoids the floodplain, if possible, or if unavoidable, to minimize the impact. In many cases, the strict application of this provision can move a structure out of the floodplain and help prevent future damages, plus save the additional cost involved with floodplain construction.

1. Basements

Basements are not permitted in the 100-year floodplain. However, enclosed areas below the FPE may be permitted, provided certain conditions are met. The NFIP defines a basement as an enclosed area having a floor (finished or unfinished) that is below grade on all sides, and does not specify a depth below grade. If a building is elevated on solid foundation walls, creating a crawl space underneath, a "technical basement" may result when backfill is placed against the foundation wall to provide drainage away from the building. Care should be taken to assure that, on at least one side, the final grade on the interior of the foundation wall will be at least as high as on the exterior, after final grading is complete. Otherwise, the NFIP could consider the floor of the technical basement as the lowest floor, resulting in noncompliance and higher flood insurance premiums.

2. Lowest Floor and Enclosed Areas Below the BFE

The NFIP regulations and the State Model Ordinance require that the lowest floor of all new or substantially improved post-FIRM floodplain buildings be elevated to or above the BFE (NFIP) or the FPE (State Model). Lowest floor is defined by the NFIP as:

"the lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement is not considered a building's lowest floor, provided that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of Section 60.3".

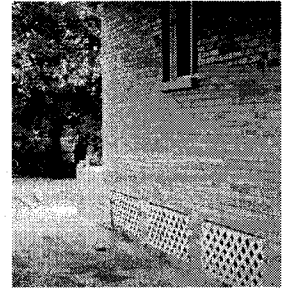
Enclosed areas below the FPE may be permitted in A-zones, provided they meet certain criteria specified in Section 60.3:

- Enclosed areas may not be subgrade on all four sides, thereby creating a basement, which is not permitted in the floodplain;
- The area must be strictly limited in use to parking of vehicles, limited storage, and/or access to the building;
- No electrical or mechanical equipment may be located below the FPE, including, but not limited to, heating

and cooling equipment, hot water heaters, pressure tanks, electrical junction boxes or circuit breaker panels, washers, dryers, freezers, toilets, and sinks;

- All interior wall, floor, and ceiling materials located below the FPE must be resistant to flood damage or left unfinished; and,
- An enclosed area must be supplied with at least two water equalizing vents on different walls. The bottoms of the vents may be no more than one foot above grade. These vents must have a total effective open area of one square inch for each square foot of enclosed area below the FPE, and operate to allow **automatic** entry and exit of flood waters.

If any of the above criteria are not met, the structure is not compliant with Section 60.3 and is in violation of the permit (assuming it was issued properly). The Elevation Certificate must certify the top of the floor of the enclosed area below the FPE. The community that issued the permit must take action to correct the violation to maintain good standing in the NFIP.



Floodplain construction design standards are intended to reduce damage during flooding. The venting requirement for floodplain construction addresses the structural integrity of the support system of the entire building. Proper venting, along with the requirement that the building be securely anchored to an adequate foundation system, will help prevent the most severe damage encountered during flooding - failure of the foundation.

The use of building materials normally associated with living areas above the FPE is prohibited in enclosed areas below the FPE. However, materials necessary to meet applicable fire resistance codes are permitted. Also, machinery and electrical equipment may be located in enclosed, vented areas subject to flooding, as long as they are installed at or above the FPE. Electrical distribution panel boxes must be at least 2 feet above the FPE and should be situated so that they can be accessed from a dry location during flooding. A minimal area to serve as an entry foyer and stairs to the elevated floor above may be finished off. If loss of heat is a concern in a vented enclosed area, styrofoam panels may be taped to the **inside** of the vents. These will break loose under hydrostatic pressure and allow the vent to function. Any obstruction which will not allow the vent to function during flooding is not permissible.

An attached garage or storage area, if it meets the criteria above and has one side at or above grade, is not the lowest floor. However, these areas must be vented properly and have no electrical or mechanical devices installed below the FPE. If these provisions are not met, the floor of the garage or storage area must be considered the lowest floor and it will be in violation of the floodplain management ordinance.

3. Substantial Damage and Substantial Improvement

Substantial improvement is any reconstruction, addition, repair of damage, or other improvement to a floodplain structure, the cost of which equals or exceeds 50% of the market value of the structure before the start of construction of the improvement. The term also includes structures which have sustained substantial damage from any cause which is equal to or greater than 50% of the market value of the structure before the damage occurred. These structures must be treated as new structures in applying the full requirements of the ordinance. The 50% threshold was chosen as a compromise between the extremes of either prohibiting all investment to existing structures in flood hazard areas which do not meet current floodplain requirements, or allowing additional investment without regard to meeting any floodplain requirements.

The calculation is based on the full market value of the structure before the substantial improvement and the actual cost of the improvement or repair. The fair market value of labor and material must be included in the cost of improvement. Only cost of plans, permits, and surveys may be excluded. For substantial damage, the cost of repair may not be less than the amount of damages. Full market assessed value of the structure only (not land) may be used in Maryland, in lieu of a real estate market appraisal. For permitting purposes, the cost of improvement may be an estimate from a contractor, or cost per square foot (such as \$40 per square foot for residential frame construction) for the areal extent of improvement. Such figures are available from building cost information services such as Marshall and Swift, National Construction, Dow Building, and Boeckh. In the case of insured substantial damage, the flood insurance adjuster's worksheets or Proof of Loss Statement may be used for cost of repairs.

Cumulative substantial improvement is not addressed in the federal regulations. Over a number of years it may be natural for the cumulative improvements to exceed 50%, as a family or business grows. However, permitting officials should not allow the deliberate phasing of improvements over a one to two year period to circumvent the regulation. The

State Model requires tracking of substantial improvements only for structures in floodways and coastal high hazard areas (V-zones) to give the community more control in these more hazardous areas. In this way, the community can require proper elevation and conformance with current requirements once the 50% threshold is reached or exceeded.

The cost of making the minimum necessary repairs to correct previously identified violations of health, sanitary, and safety codes may be subtracted from the cost of improvement. Exempted from substantial improvement is any alteration to a historic structure, provided that the alteration will not jeopardize the structure's continued designation as a historic structure.

In pre-FIRM (before the community entered the regular program) structures, less than substantial improvements are exempted from the NFIP elevation requirement. Less than substantial improvements to post-FIRM structures (built after the community entered the regular program) must be elevated to the elevation required by the ordinance in effect at the time the building was originally built. However, if the improvement is substantial, it must be built to the elevation and requirements currently in effect. Interior renovations which constitute substantial improvement trigger elevation of the structure.

Permits issued for improvements which may be substantial must be carefully documented in the permit file as to whether they are substantial improvement or not. The regulations are not intended to be triggered by maintenance, such as reroofing and residing a house. However, combined maintenance projects on a single permit may trigger substantial improvement, especially in low value structures.

4. Additions

Pre-FIRM structures which are substantially improved by additions are regulated by specific guidelines. If a horizontal addition is added by leaving the existing wall intact, and the only alteration to the existing structure is a doorway to the addition, only the addition must be elevated. If the wall is substantially removed and the addition is incorporated into the existing part, however, both the addition and the entire existing structure must be elevated. Vertical additions, such as second story additions, are likely to be substantial and will modify the existing structure, requiring the entire structure to be elevated to the FPE. Any less than substantial additions to post-FIRM structures must be elevated to the level required by the ordinance in effect at the time the structure was built.

Maryland regulations require that less than substantial additions in the nontidal floodplain be fully elevated to the FPE. These regulations also do not allow the floodproofing option in nonresidential additions. Therefore, tidal areas are governed by the provisions of the local ordinance, while nontidal areas are governed by the more restrictive State regulations.

For additions, the permit file must be properly documented with calculations indicating substantial improvement or not and the nature and extent of the addition and other modifications.

5. Historic Structures

Permits for substantial improvements to historic structures may be issued after a variance to the elevation requirement is issued, if compliance would jeopardize the historic nature of the structure. To qualify, the structure must be individually listed, or be eligible to be listed, on the National Register of Historic Places, Maryland Inventory of Historic Properties, or in a National Register Historic District or an approved State or local historic district, provided the structure has been determined to contribute to the historic significance of the historic district. In addition, the historic structure must be able to maintain its listing or historic significance after the renovations are completed. The variance must document the need to maintain the historic nature of the structure and that compliance would destroy the historic nature.

As in all variances, a Declaration of Land Restriction should be recorded against the deed specifying how the structure fails to meet current floodplain requirements and why the variance was granted.

6. Accessory Structures

Accessory structures are separate structures on the same parcel of land as the principal structure. Their use must be incidental to the principal structure. Usually, they are detached garages, sheds, and implement buildings. Generally, they need not be fully elevated, provided they meet certain conditions found in Section 6.6 of the State Model Ordinance including anchoring and water equalizing vents. Accessory structures may not be used as commercial structures from which to conduct a business.

If electricity is supplied, all outlets must be dropped from above and be elevated to or above the FPE. Construction materials which will be below the FPE should be water and flood resistant. Mechanical and electrical equipment must be elevated to or above the FPE.

Requirements for accessory structures are covered by the Conditioned Permit provisions of the State Model Ordinance. Use of the Nonconversion Agreement specifies the conditions needed to meet the NFIP regulations. In addition, it should be noted that all structures must be adequately anchored to prevent flotation. In small sheds, over the top ties to ground anchors or bolts embedded in a concrete pad will suffice to meet the anchoring requirement. Even small sheds must have water equalizing vents. Unanchored, unvented sheds can be swept into other structures and cause additional damage during flooding.

7. Manufactured Homes and Recreational Vehicles

Similar requirements apply to manufactured homes placed, replaced, or substantially improved in the floodplain as to other primary structures. They must be fully elevated to or above the FPE on a reinforced pier foundation, and anchored to resist flotation, collapse, or lateral movement, even under saturated soil conditions. Elevation on dry stacked blocks is not permissible. Concrete blocks may be used to elevate manufactured homes in flood hazard areas only if they are reinforced by filling the hollows with cement, placing reinforcing bars inside and extending them into the footing. There must be an integral connection from the I-beam of the unit through the foundation, using rebar or similar material. Acceptable pier designs can be found on pages 49-52 of Manufactured Home Installation in Flood Hazard Areas, which determines what design is appropriate in specific situations. Piles, columns, and perimeter foundation walls may also be used in lieu of piers. Flood velocity, erosion, and depth of scour should be considered in choosing the foundation design. Anchoring must include use of over-the-top and frame ties to anchors embedded in the concrete footing to resist water and wind movement.

New placement or replacement of manufactured homes in floodways and in coastal high hazard areas is prohibited in the State Model Floodplain Management Ordinance.

Recreational vehicles located in the floodplain may be exempted from the elevation and anchoring requirements if they are (1) located on the site less than 180 consecutive days per year, and (2) fully licensed and ready for highway use. To meet the "ready for highway use" standard, the vehicle must have no permanent attachments and have quick disconnect utilities, so that it can be moved quickly. A quick disconnect screen porch designed to be disassembled in about an hour is permissible, if it is not affixed to the vehicle and if at least two hours of warning time will be available.

8. Dry Floodproofing Nonresidential Structures

In Maryland, floodproofing is an option only for new or substantially improved nonresidential structures in the tidal floodplain. It consists of a combination of structural and nonstructural components to reduce or eliminate flood damage to the structure. It includes strengthening the foundation walls against the hydrostatic and hydrodynamic flood forces and sealing the foundation wall against the penetration of water. Hydrostatic flood force is the pressure exerted against the wall by the water (or saturated soil) on one side of the wall. It increases by 62.4 pounds per square foot for each foot of water depth. Hydrodynamic forces are exerted on the wall by moving water, including the impact of debris, and varies with the velocity of the water and the area exposed. Also, the effect of buoyancy must be considered in floodproofing designs.

The building must be watertight to the FPE, meaning that no more than 4 inches of water depth due to seepage is allowed during a 24 hour period, if no devices are provided for the water's removal. All utilities must be elevated to or above the FPE, or they must be made watertight and capable of resisting damage during flooding. This requires that sanitary drains be supplied with valves to prevent entry of floodwaters or escape of sewage during floods. Any floodproofing plan should include a periodic inspection and maintenance plan to ensure that all components will operate when a flood occurs. The design should take into account that electric power is unlikely to be available during flooding.

Floodproofing designs require the completion of a Floodproofing Certificate for Nonresidential Structures by a registered architect or engineer. The form should be supplied to the community with the proposed design prior to the issuance of a permit. In complicated cases, the community should seek assistance in the review of the floodproofing design plans. It is the responsibility of the community to assure that the floodproofing design is implemented during construction.

Although the NFIP allows the use of devices which require human intervention in floodproofing designs, the State Model does not. Such devices include flood doors, window shields, and manually operated valves and pumps. Additional considerations regarding warning time, safe access during flooding, and flood depths and velocities make human

intervention an undesirable option. A Flood Emergency Operation Plan with periodic training and drills is required. For these reasons, a community should not consider human intervention an option in floodproofing designs.

Additional information on floodproofing may be found in FEMA Technical Bulletin 3-93, "Non-Residential Floodproofing- Requirements and Certification", and in the U. S. Army Corps of Engineer's Floodproofing Regulations. Specific design examples appear in FEMA 102, Floodproofing Non-Residential Structures. Also useful is Technical Bulletin 2-93, "Flood-Resistant Materials Requirements", which rates different materials according to their flood/water damage resistance. All of these documents may be ordered by calling the FEMA Publications Warehouse at (800) 638-6620.

9. Wet Floodproofing Nonresidential Buildings

The preceding discussion refers to "dry floodproofing". In a few cases, "wet floodproofing" may be the best alternative in a nonresidential building's design in an A-zone. In this case, the building is purposely designed to allow floodwaters to enter during a flood without causing damage. Examples may include boat storage facilities, boat repair buildings, airplane hangars, pole barns, and storage buildings for nonhazardous flood resistant materials. Such building designs must have sufficient openings to allow hydrostatic pressure to equalize, air vents to release trapped air, adequate anchoring, and good drainage to allow water to escape. The structure shall be constructed of flood and water resistant material, with utilities elevated or dry floodproofed. Further guidance is provided by NFIP Technical Bulletin 7-93, "Wet Floodproofing Requirements".

The NFIP has no provisions for such designs, so a variance would have to be issued by the community. Each wet floodproofing design would have to be considered on its own merits, which should consider the flooding situation, as well as the building's design and intended use. The contents should not be able to escape during flooding. Later use of the building should not change to one that is incompatible with the wet floodproofing design. The fact that flood insurance rates would be high, since the NFIP does not recognize wet floodproofing, would be a major consideration. Comments should be requested from the State NFIP Coordinating Office if such designs are being considered.

10. Agricultural Buildings

Wet floodproofing may be appropriate for certain types of agricultural structures located in wide, expansive floodplains, such as the Eastern Shore of Maryland. A variance may issued as described in Section 9, above, if the structure is used solely for the production of agricultural commodities, including livestock, and has no residential uses. The design must demonstrate that minimal damage will result to the building and its contents during the 100-year flood. The variance must address both the nonconforming flood protection design and the restriction in use to the proposed agricultural activity, which must be recorded on a Declaration of Land Restriction or against the deed to the building. Applicants for such designs must be advised in writing that flood insurance may be very expensive for structures built below the BFE, and this fact recorded against the deed. The cost of purchasing flood insurance on a noncompliant building could outweigh the cost of bringing it into conformance.

The building must be adequately anchored and vented and provisions made for the escape of air. Areas which are below the FPE must be constructed of flood and water resistant materials. Electrical connections and machinery must be elevated to or above the FPE. Safe access and warning time to remove equipment or livestock are important considerations.

11. Utilities

The NFIP regulations require that all public utilities, such as sewer, gas, electrical, and water systems be located and constructed to minimize or eliminate flood damage. Water supply systems must be designed to minimize or eliminate the infiltration of flood waters into the system. New and replacement sanitary sewage systems must be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters. Also, on site waste disposal systems must be located to avoid impairment to them or contamination from them during flooding. Some Maryland communities have interpreted this provision to mean that septic systems should not be located in the floodplain.

All components which are not sealed against the penetration of water must be elevated to or above the FPE. Items such as toilets, sinks, showers, water heaters, furnaces, heat pumps, air conditioners, air distribution systems, generators, and other permanent plumbing and electrical installations must be elevated. Electrical equipment on the structure side of the meter must be properly elevated. Since the electric utility controls the placement of the meter, it is possible that it may not be fully elevated. Communities should encourage utilities to elevate and protect meters and transformers.

12. Liquid and Gas Storage Tanks

Liquid and gas containers are considered structures and are subject to extreme hydrostatic pressure during inundation. Where possible, such containers should be elevated to or above the FPE or placed out of the floodplain. Newly installed tanks that are in the floodplain but not elevated are required to be anchored to withstand a buoyant force acting on it in its empty state. Buried tanks must be anchored sufficiently to be certified by a registered engineer to not float up even under saturated soil and flood conditions. Containers should have water tight fill caps and vents that extend above the expected flood level, and should be labeled as to contents. Labeling allows emergency personnel to identify contents and how to deal with tanks in emergency situations, if they do break loose. In some instances, it may be prudent to fill empty tanks with water if flooding is impending, although disposal of the contaminated water after flooding may be a problem.



I. Other Items Of Concern

1. Electric Meters and Transformers

Although the NFIP does not regulate the placement of electric meters and transformers in the floodplain by power companies, floodplain managers are concerned about their compatibility with the NFIP's stated goals. The program's goal is protect structures for continued habitability and return to normalcy as quickly as possible after a flood. Power companies prefer to install electric meters at eye level for ease of reading. As more power lines are installed underground, transformers are being installed at grade for easy access, rather than on poles. In many communities, especially on the Eastern Shore, a large amount of utility infrastructure serving a community may be below the BFE, and questions need be to raised about the power company's ability to restore power quickly after a flood.

If electric meters were inundated by floodwaters, electrical power could not be provided to homes until the meters are replaced. Transformers would fail when inundated by floodwaters, cutting off power to large numbers of homes and businesses. The amount of damage sustained under these conditions and the power company's ability to restore power quickly is unclear. Damage could be especially severe in tidal areas where brackish water would come into contact with utility equipment.

The electrical supply system is owned and maintained by the power companies, who have decided to adopt certain emergency repair or replacement procedures rather than elevate or floodproof vulnerable components of the system. Transformers could be placed out of the floodplain or on platforms above the FPE, if power companies are convinced of the need to do so. In lieu of that, communities should request a comprehensive plan from the power company to restore service following a major widespread flood, and evaluate its acceptability with regard to the availability of replacement parts and the time to restore service.

The guidance from FEMA is that communities should work closely with the local utility companies to address the company's concerns, but, more importantly, the needs of their residents to have electric power without extended periods of no service. If a community is satisfied with a company's emergency repair or replacement procedures, electric meters would not be considered part of a residence's utility systems. However, FEMA encourages that meters be elevated as close to the BFE as possible.

Proper elevation of electric meters could be addressed by strict enforcement of the NFIP regulations incorporated into all local ordinances, which require that wires entering a structure beyond the meter be elevated to or above the FPE. If electrical inspectors ensure that wiring entering the building is at or above the FPE, this would force the placement of the meter box. The building design may have to incorporate some concessions to the meter reader, such as an access platform or location of the meter near stairs. However, in most cases, meters could be placed at reading level and still be properly elevated. Cooperation among the power companies, electricians, builders, and electrical inspectors could insure that buildings will not be without power because of meter failure following a 100-year flood.

2. Utilities to Piers

Maryland has a large number of piers with electric service for boaters. Although elevation of all electric components would present a practical hardship, it is not prudent to have live electric power subject to flooding without protection, especially in salt water applications, where danger of electrocution is severe. The prudent approach is to have the main supply panel located three feet above the BFE, and provide ground fault interruption circuit (GFIC) breakers at the supply panel for all branch circuits supplying power to outlets subject to inundation. This would allow immediate circuit interruption upon flooding at the lowest outlet. All wiring should be shielded and run under the pier with no connections

except at receptacles.

Electricians, however, claim that the GFIC breakers currently available on the market are too sensitive for these applications. They are designed for use in buildings under dry conditions. High humidity in outdoor applications would cause excessive false tripping. Also, running the circuit for distances greater than 250 feet would create problems with the GFIC breakers. The National Electrical Code Handbook specifies grounding, but not GFIC protection, for marina applications.

Floodplain managers should be concerned that proper protection for electrical service to piers is not being addressed adequately by either the Electrical Code or the manufacturers of electrical equipment, and try to force changes in both. Until better alternatives are available, we must either require strict elevation of the electric service, or grant variances to allow branch circuits on piers below the FPE without proper protection. Neither of these is a good option.